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CRUCIAL CONNECTION — Sandia researcher Leonard Martinez, at the “friendly” EMP emitter facility called the ElectroMagnetic Environment Simulator, connects a high-voltage-insulating line that circulates oil between a coaxial transmission line (white tube on the left) and the blue oil-filled transmission horn. (Photo by Randy Montoya)

'Friendly' EMP improves survival for electronics

By Neal Singer

An electromagnetic pulse, or EMP, emitted by a nuclear weapon exploded high above the United States could disable the electronic circuits of many devices vital to military defense and modern living. These could include complicated weapon systems as well as phones, laptops, credit cards and car computers. Also in trouble might be home appliances, gas station pumps and bank accounts. Fortunately, military equipment is designed to be immune to various levels of EMP, and the validity of its designs — and some civilian designs as well — has been tested and improved by a “friendly” EMP generator installed in a recently renovated facility at Sandia. The ElectroMagnetic Environment Simulator, or EMES, consists of a hippopotamus-sized Marx generator that sits alone in a small laboratory. The large capacitor bank stores electrical energy and releases it upon command. The resulting blast of energy, in the form of an electromagnetic pulse, can be focused on a target every 15 minutes. Absorbers at the far end of the test chamber gobble up the energy not absorbed by the object being tested. “An EMP pulse generated by an adversary would be

an attempt to disrupt our communications or other equipment,” said Leonard Martinez, the Sandia researcher in charge of the timing and firing control system. “Recent advancements now enable us to provide that pulse within a microsecond of the unit’s timing requirement.” The idea is to explore the effects of the energy pulse by testing an item at critical moments during its processes. Learning when and where a problem may occur in the unit permits engineers to design better EMP shielding to prevent such upsets. Sandia’s EMES testing process involves trundling components into the target area, subjecting them to the rapidly peaking EMP and then removing them to make way for the next item to test. Preliminary results are provided immediately, Leonard said, and a longer report with more extensive analysis is issued later. “The builders or owners generally solicit help from my group when it comes to additional shielding designs,” Leonard said. The design focus can range from protecting tiny electronic parts to shielding larger subsystems of military equipment. “Our customers may decide to implement additional shielding to their device in between tests, or even take the device back to their lab to design and

add additional shielding,” Leonard said. “Then they would bring it back for retesting.” If the device passes the specification level test at normal energy requirements, its owners may ask the test facility to increase the EMP electric-field amplitude in incremental steps to determine the device’s capabilities at higher threat levels. “This gives the customer a better level of confidence about their product,” Leonard said. Earlier versions of the pulse-producing machine operated from 1978 to 1994. The test facility lay fallow until after the 9/11 attacks, when it was resurrected to test communications across the nation in the event an adversary could generate an EMP in or near the United States. ‘Could we still communicate? Would our radios, televisions, microwave ovens and refrigerators work after such a pulse arrives,’ was the question,” Leonard said. The renovated facility was intended to support the NNSA mission but over time came to satisfy military missions and civilian needs. It continues to do so. Sandia researchers are working to integrate EMES into a national EMP test facility focused on increasing the resiliency of the nation’s electric grid.

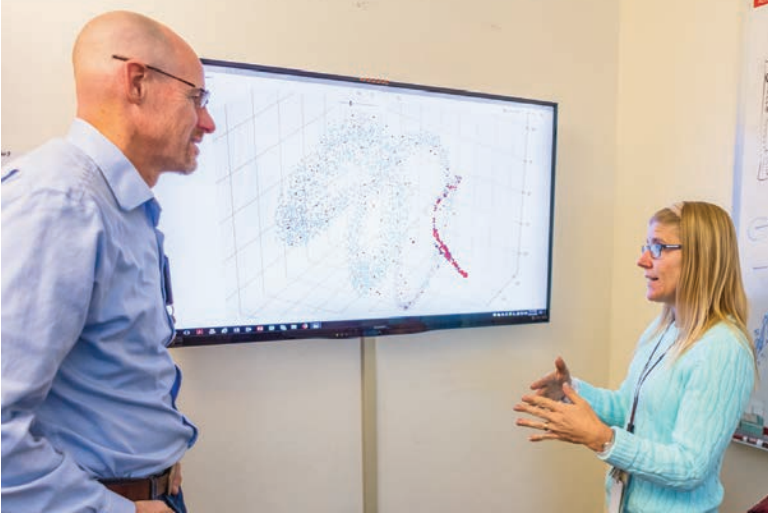
'Research Club' enhances research culture and capabilities

By Julie Hall

Sandia Fellow Kathy Simonson has read hundreds of research proposals during her career. She’s also served on several investment area teams, which review and score Laboratory Directed Research and Development ideas and proposals. She noticed that among the weaker proposals, many of the same issues kept cropping up, including ideas that were not adequately structured within the context of the LDRD call or proposals that were poorly written and didn’t address the key question “Why should anyone care?” “Even folks with tremendous educational backgrounds did not always understand how to develop a good research proposal,” she said. This experience, combined with the observation that her own center had largely “self-selected” out of the LDRD program, gave her the idea for a “research club.”

Kathy said her center in the Global Security Division historically has had the lowest rate of LDRD idea submissions, even when it was part of the National Security Division prior to the Labs’ contract change in May 2017. In fact, only one idea went to the full proposal stage last fiscal year. This meant that an important resource for discretionary research and development, funded in part by the LDRD “tax” levied on the center’s external funding, was largely supporting R&D in other organizations. In addition, Kathy said, “we were failing to pursue new technical directions that could lead to funded programs in the future.” The basic premise behind the center’s Research Club was to combine the small group dynamics of peer mentoring with more traditional mentoring while coaching

(Continued on page 4)



COACHING SESSION — Computer scientist Kurt Larson (left), a “coach” in Division 6000’s Research Club, discusses data in a visualization algorithm with fellow computer scientist Jenny Galasso, part of her Exploratory Express research proposal. (Photo by Nicholas Kerekes)

US-UK Mutual Defense Agreement: 60 years of unprecedented partnership



SANDIA US-UK CONFAB — Among the leadership attending the 1958 meeting at Sandia, from left: Brig. Gen. A. D. Starbird, Chairman of the U. S. Delegation and Director Division of Military Application, AEC; R. W. Henderson, Vice President-Development, Sandia Corporation; Dr. Norris E. Bradbury, Director, Los Alamos Scientific Laboratory; Sir William Cook, Chairman, United Kingdom Delegation and Member of the Atomic Energy Authority; Dr. Edward Teller, Director, Livermore Laboratory of the University of California Radiation Laboratory; and Maj. Gen. Herbert B. Loper, Assistant to Secretary of Defense for Atomic Energy. (Sandia archival photo)



By Rebecca Ullrich

This year, 2018 marks the 60th anniversary of the 1958 signing of the Mutual Defense Agreement between the United States and the United Kingdom.

Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the United States of America for Cooperation on the Uses of Atomic Energy for Mutual Defense Purposes

Article I, General Provision:

While the United States and the United Kingdom are participating in an international arrangement for their mutual defense and security and making substantial and material contributions thereto, each Party will communicate to and exchange with the other Party information, and transfer materials and equipment to the other Party, in accordance with the provisions of this Agreement provided that the communicating or transferring Party determines that such cooperation will promote and will not constitute an unreasonable risk to its defense and security.

Signed July 3, 1958
In force August 4, 1958
Currently extends to 2024

For 60 years, the United States and the United Kingdom have shared ideas, information, materials and equipment within the enabling provisions of the Mutual Defense Agreement (MDA). Without limiting either nation’s independent actions, the MDA allowed for an unprecedented partnership in national security, including nuclear non-proliferation and counterterrorism, naval nuclear propulsion and maintaining the basic integrity of each nation’s nuclear stockpile.

Under the auspices of the agreement, the two nations have established a system of liaisons and cooperative programs that define and support information sharing. That system was built in a series of meetings held after the MDA went into force in 1958. One of those meetings, held September 15-19 at Sandia, focused on sharing the weapons systems then in design or production.

In 1958, the world was deep in the Cold War arms race and the competition, the stakes, and the politics were apparent to everyone involved in establishing and sharing under the umbrella of the MDA. For example, the 1958 theme for Sandia’s annual Savings Bond drive was satellites — Sputnik launched Oct. 4, 1957. The U.S. and U.K. had much to discuss about their respective nuclear weapons programs and how they might work together more closely in the future.

The 1958 meeting at Sandia was broken up into sessions — topical ones on theory and engineering and then sessions covering particular weapon systems. Each involved a great deal of discussion as scientists and engineers from the institutions involved in nuclear weapons design, development and use came together to understand each other’s work. They questioned each others’ decisions – not in a confrontational manner, but in an effort to understand differences in philosophy, approach, preferences and, ultimately, product. The sessions were recorded and transcripts produced. We know what they talked about in some detail.



OUT OF THIS WORLD CAMPAIGN — The U.S.S.R. launched the first artificial satellites — Sputnik I and II — in October and November 1957. The U.S. placed Explorer I in space two months later, so the cost and intensity of the Cold War were on everyone’s mind in 1958. Satellites were the focus of a May 1958 Bond Blitz during Sandia’s “Share in America” week. A major part of the campaign were signs and satellites in hallways around the Labs, emphasizing that government programs are not cheap and buying Savings Bonds is a way to loan money to Uncle Sam while gaining a guaranteed return. (Sandia archival photo)

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MOURNING A LEADER — President George H.W. Bush, who died Nov. 30 at age 94, visited Sandia New Mexico on Sept. 16, 1992, and met with researchers at the robotics range, microelectronics lab and other facilities. During his visit, he announced major additional funding for nuclear non-proliferation programs. (Photo by Randy Montoya)

Full STEAM ahead

Sandia supports scientific adventures

Story and Photos by Jules Bernstein

It isn't even 2019 yet, but Sandia has already kicked off a new year of supporting science in elementary schools. The first Family STEAM Night at Sankofa Elementary in Oakland, California, featured a carnival theme that attracted dozens of students and their parents.

Building roller coasters for marbles, making ice cream from scratch and learning the science of midway games were just a few of the projects that engaged kids in science, technology, engineering, arts and math during the Nov. 13 event.

In addition to a Sandia grant that made the event possible, several Sandia staff members volunteered to lead project stations. Systems engineer Raheel Mahmood took part in several previous local education events, but he said the flashy big top theme of this STEAM night made it particularly unique and fun.

Learning games under the carnival tent

Raheel led the marble roller coaster activity, which gave students construction materials, some design constraints and a goal of building a track for a rolling marble. Raheel and other facilitators guided students in proposing their own designs, building them, understanding what did and didn't work, then helping them improve on their design.

"I really appreciate how supportive Sandia is of education and outreach initiatives," he said. "These events can help students, teachers and parents appreciate science, and shows how engineers and scientists can be positive influences in the community."

Khelsey Pellum, a kindergarten teacher at the school, agreed completely with Raheel's sentiment. She said she felt the STEAM night was a great way to excite students' love of learning. "One of my students saw me and ran across the room to show me how she made her 'air-zooka' balloon launcher," Pellum said. "I thought, 'Wow! Look at how she's so engaged in this!'"

Turning entertainment into engineers

The event was organized by Scientific Adventures for Girls. After learning that California kids get, on average, less than an hour of science instruction every week, that many after-school science programs were expensive and that women are greatly underrepresented in STEM industries, Courtney Carr Heuer and Tiffany Sprague were inspired to start the organization.

Their mission is to keep all kids, especially girls and underserved youth engaged in STEM for the long term. Carr Heuer said, "We are trying to make sure that girls from underrepresented areas have the opportunity to fall in love with STEM, and ultimately give them a better chance at economic mobility."

To that end, the group will host five more Family STEAM Nights in Oakland throughout 2019. Typically the events run 5-7 p.m., for kindergarten through fifth graders and their parents. Anyone interested in volunteering should contact community relations specialist Kayla Norris.



WE ALL SCREAM FOR ICE CREAM — It's tough to tell whether this student was just excited by the prospect of eating the ice cream he is making here, or if his hands were also freezing.



ALL SMILES — Sankofa Elementary School teacher Khelsey Pellum, a big fan of Family STEAM Night, takes a short break from the action.



AIMING HIGHER — Software engineer Marisa Stansfield helps a student build a balloon-launching 'airzooka.'



FOCUSED ON FUN — Sandia systems engineer Raheel Mahmood shows a student how to construct a roller coaster track for marbles.



MICHAEL COOK

Marine's contribution to national security continues at Sandia

By Michael Padilla

Michael Cooke was enlisted in the U.S. Marines for four years. Being deployed in Kuwait and Iraq for eight months taught him to be aware of his surroundings and how to focus at the task at hand. Now Michael serves as a technician for Sandia/California's Security Operations and Emergency Management organization. He helps maintain hardware to ensure the site is safe and secure.

Michael said he was fortunate to work with individuals from throughout the U.S. The best part of being a Marine, he said, was forging strong connections with those he met during his four years of service.

"It was fantastic to serve as a Marine," Michael said. "The camaraderie and community between Marine brothers and sisters is something that I will cherish forever. The people I met and served with are friends for life."

From 2011 to 2015, Michael was stationed at the Marine Corps Air Ground Combat Center, also known as 29 Palms, in southern San Bernardino County, California. He deployed to Kuwait and Iraq from September 2014 through April 2015.

Michael says he would re-enlist in the Marines if he could. However, he feels he is continuing to make a difference by helping to keep the nation safe as a member of the Sandia workforce.

Prior to Sandia, Michael worked at Cargill Salt in Newark, California.



Sandia/California donates coats, food through Sandia Gives campaign

Story and Photo by Michael Padilla

Warm coats and food collected during the Sandia Gives campaign were recently delivered to organizations that help Livermore area residents in need.

This year, two events aimed at gathering warm coats and non-perishable food items were held at Sandia/California.

Sandia's Krissy Galbraith led the coat drive for the site. This was her seventh annual coat drive at Sandia and her 13th overall on behalf of One Warm Coat. This year the coats were delivered to Tri-Valley Church of Christ in Livermore, which provides clothing assistance to anyone in need.

"This year, the site collected 150 coats," Krissy said. "This is a significant number of coats that will help warm those in need this winter. We are very fortunate to work at a place with so many caring hearts."

Sandians donated more than 125 pounds of food to the Tri-Valley Haven Food Pantry. An additional 75 pounds of food and a \$25 check went to Second Harvest Food Bank.



ONE WARM COAT — Members of the Tri-Valley Church of Christ are all smiles after Krissy Galbraith delivers 150 coats donated by Sandia/California. The coats are provided to those in need in the surrounding area.

Sandia researchers win five R&D 100 awards

By Neal Singer

Competing in an international pool of universities, corporations and government labs, Sandia inventions and co-inventions captured five R&D 100 Awards this year.

Each year, R&D Magazine editors and independent judges determine the researchers who have developed the year’s 100 most outstanding advances in applied technologies. The awards focus on practical impact rather than pure research and recognize entrants for their products’ designs, development, testing and production.

The sole criterion for winning, according to a description released by the magazine, is “demonstrable technological significance compared with competing products and technologies.” Properties noted by judges include smaller size, faster speed, greater efficiency and higher environmental consciousness.

The R&D 100 Awards began in 1963. Since 1976, Sandia has earned 124 awards.

This year’s five Sandia winners are pictured here:

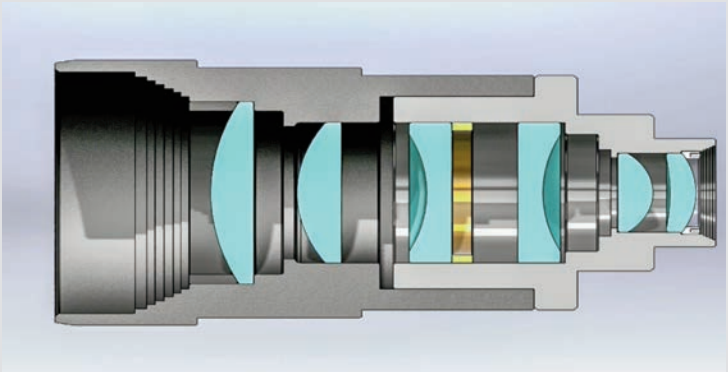


LAMMPS simulations for materials modeling

LAMMPS is a widely-used molecular dynamics simulation package that models materials from the atomistic to mesoscale to continuum scales. It can be run on machines from desktop computers to the largest supercomputers, to explore the structural and dynamic properties of materials and provide insights not easily accessible to experimental observation.

SWiCK Zoom, or Sandia wide-angle quick zoom

The technology uses variable focal-length lenses or mirrors to toggle between high and low magnification almost instantly, enabling users to achieve true optical zoom with minimal power. Compact, lightweight and low-power systems are ideal where size, weight, speed or battery power come at a premium, in such applications as cameras on drones, cell-phones and self-driving cars.



Detergent-assisted fabrication of functional materials

Application of ordinary detergents can produce uniform sizes and shapes of multifunctional materials at the nanoscale level, boosting their performance. Possible uses of the technique range from environmental cleanup to cancer treatment, while reducing costs.



Large Field-of-View Bench-Top 3D X-ray Phase Contrast Imaging (XPCI) system

The system makes it possible to image low-density materials, such as the human body, polymers, epoxies, fillers, foams, plastics and other materials with as much as a thousand times more sensitivity than ordinary X-ray imaging.



Power API

Power API is a computer interface that users, applications, system tools and administrators can operate to understand and control power usage. It works through existing programming paradigms governing all modern computers’ operations.

‘Research Club’

(Continued from page 1)

participants at each stage of developing an idea into a research proposal.

Managers and senior managers selected 10 early- to mid-career researchers to participate in the pilot from July 2017 to May 2018. In weekly, hour-long meetings, Kathy and the other experienced “coaches” — Tian Ma, Mark Van Benthem and Kurt Larson — led participants through a curriculum that mirrored the stages of developing a research proposal, from idea generation and literature searches, to shaping ideas within the context of the LDRD call, finding an appropriate investment area, writing the idea proposal, presenting to proposal selection teams and executing newly funded projects.

LDRD homework

There was “homework” between meetings, such as reading through the LDRD call, thinking about research topics and conducting literature searches. Each club member, individually or with a partner, was expected to submit an idea proposal for the FY19 LDRD call.

The researchers also learned more about Sandia’s LDRD process and the “Heilmeier Catechism,” a set of questions developed in the 1970s by former Defense Advanced Research Projects Agency director George Heilmeier to help agency officials evaluate proposed research programs.

“If you can answer those questions about your proposal and explain this to the review team, you’ll be in good shape,” said computer scientist Jenny Galasso, a member of the inaugural Research Club.

Jenny, who has been at Sandia since 2001, had not heard of the Heilmeier principles prior to participating in the Research Club, nor had she previously participated in the LDRD program. To her, the most valuable part of the club was the access it provided to the three coaches, who provided feedback and guidance at every stage in the development of her proposal.

“I got out of it a thousand times more than I expected,” she said.

Jenny said it was helpful to learn how to reach out to technical experts around the Labs to get input on her idea. The LDRD proposal process involves an internal peer review. “It’s good to advertise your proposal in

advance,” she said. “Those reviewing your proposal should be aware of it in advance because they often don’t have a lot of time to review it.”

Her proposal, “Machine Learning of Signal Patterns for Protocol Informatics,” was selected to receive funding through Exploratory Express, a program for short-term feasibility assessments for high-risk, high-payoff R&D. Jenny said the club was instrumental in helping her develop her idea, which arose out of an opportunity she saw to combine machine learning and radio-frequency signal processing. Her project is completed, and the work is feeding into a follow-on LDRD project in another center in the National Security Programs Division.

‘A great sounding board’

Research engineer Matt Dykstra said the Research Club provided a great sounding board for bouncing ideas off a broader cross-section of the center than he would normally encounter in his daily work. Another benefit was the ability to have team members and coaches review his proposal and provide feedback on his presentation.

Matt’s LDRD proposal, “Metrology for Distributed Sensing Formations,” successfully navigated the LDRD funding process and will receive \$1.18M in funding over three years. As principal investigator, Matt will lead a team of five on the project, which seeks to develop a real-time tracking and prediction capability for satellites. Had his manager, Amy Shrouf, not recommended that he participate in the club, Matt said he likely would not have gotten involved in the LDRD program.

“The Research Club is good for getting people who have not considered LDRD to look into it and get help developing a proposal,” he said. “It’s also a good way of bringing people together to talk about things we’re interested in.”

Expansion plans

Research Club members developed six research ideas. Of these, four were submitted in response to the FY19 LDRD call for proposals, and two of these were funded. Two additional ideas were funded by external program sponsors before the FY19 LDRD call was issued.

As a result of this success and the positive feedback from participants, the Research Club was expanded in FY19. Three Research Clubs will run in parallel: two groups from Global Security kicked off in October, and a third group with members from the National Security

Programs division and the computing research center began meeting in late November. To enhance cross-organizational networking and collaboration, each club will include about a dozen members from multiple centers. The three groups will meet weekly through June, which is when oral presentations for full LDRD proposals are conducted.

When Kathy, who was appointed a Sandia Fellow in September, approached Associate Labs Director Doug Bruder about expanding the club, he immediately said yes.

“We want to maintain a culture at Sandia where employees can recognize a need and take the initiative to formulate and experiment with new ideas,” Doug said. “A challenge for leadership is to find ways to support and encourage these emerging successes without overregulating them. In this case, over a third of employees have been at Sandia five years or less, so there is a growing need for initiatives such as the Research Club that bolster our research culture and support knowledge transfer.”

John Zepper, director of Kathy’s center, said the Research Club concept dovetails nicely with the new Sandia strategic priority “Unleash the power of Sandia.” He credits Kathy’s passion for Sandia’s mission and her ability to mentor and channel people’s ideas with the Research Club’s success.

“The Research Club helps leverage the newness and excitement of the newer folks at the Labs and gives them the tools to succeed. Now that we’ve had local success with this concept, let’s share it.”

Heilmeier Catechism (as used by the Research Club)

1. What is the problem? Why is it hard?
2. How is it solved today, and what are the limits of current practice?
3. What is the new technical idea, and why can we succeed now?
4. Who cares? If you succeed, what is the impact?
5. What are the risks?
6. How much will it cost?
7. How long will it take?
8. What are the mid-term and final “exams” to check for success?

Mayor Keller talks ‘One Albuquerque’

City leader discusses crime, diversity and a brighter community future



ANALYSIS NEEDED — Mayor Tim Keller presented his vision for a safer, more inclusive city. (Photo by Randy Montoya)

By Stephanie Holinka

Albuquerque faces a diverse set of problems, and many will need the big-picture, analytical solutions for which Sandia’s workforce is known, Mayor Tim Keller told attendees at the November session of the Labs’ Community Engagement Speakers Series. Keller discussed the state of the city and the challenges it faces: discouraging crime rates, economic struggles and the brain drain of young talent leaving the state to look for work. The mayor also outlined his strategies for moving the community forward.

“We have a powerful story to tell about cultural cross-roads and resilience,” Keller said. “It should be the basis of our pride and our story and what the world knows about us. We have to take ownership of our own future.”

Introduced by deputy Labs director Dave Douglass as “Albuquerque’s most passionate and greatest supporter and cheerleader,” Keller began by thanking the Labs for its role as a valued partner to the city.

Born and raised in Albuquerque, Keller attended the University of Notre Dame and earned an MBA with honors from the Harvard Business School. Prior to being elected mayor, he served two terms in the state senate and was state auditor. Keller also learned about Sandia’s tech transfer activities during a brief stint as chair of the Science and Technology committee in the state legislature. His wife, Elizabeth Kistin Keller, is a member

of Sandia’s technical staff, so he said he’s seen the Labs first hand at Family Day.

More than a TV show

Outside the state, Albuquerque is recognized primarily by the Breaking Bad television series and the Balloon Fiesta, associations that he said hold it back.

“We have much more going for us than we give ourselves credit for. We are more than a TV show, and more than a two-week festival. But we have to remember how we got here,” Keller said.

Albuquerque has always been a city at a crossroads between the plains and the western lands, Keller said, a trading center along the Camino Real, the Santa Fe Trail, Route 66 and today’s rail crossings and the Big I.

“We should be a safe, innovative and inclusive community,” Keller said. “The challenge today is that we’re not there. We’re actually pretty far from that.”

Policing comprises nearly 2/3 of the city budget. Adding more than 100 officers this year, in addition to overtime for the current force, will leave the city unable to undertake needed projects, he said.

“The previous administration put together an amazing real-time crime center. But without extra capacity, we can’t do proactive or predictive things, so right now it is ‘the catch up crime center.’”

A planned community policing model demands assignment of non-overtime officers to multiple loca-

tions, a tremendous financial and logistical problem. “It’s an analytical exercise that, right now, we just don’t have the math to solve,” Keller said.

And Albuquerque needs help with other large-scale analytical problems.

“We have all the data you could ever want, but we don’t have anybody to do the analysis,” Keller said.

Another logistical challenge he pointed to is homelessness.

“Albuquerque is one of the only major cities that lacks a centralized place to go for services,” Keller said.

Dozens of nonprofits help the homeless in different ways, but they’re spread throughout the city, so it could take an individual all day trying to get from job training to health care to lunch and then to someplace to sleep.

“We have to have a centralized place where people can go to access service providers,” the mayor said.

Another challenge is mapping educational enrichment opportunities and creating new ones for children to supplement the Albuquerque Public Schools with extracurricular and summer programs. He said the city provides such programs for about 20,000 children, but he wants to serve around 80,000.

The city is also looking for ways to implement the Smart City program, installing cameras and sensors to optimize transit and other services, Keller said, and is working with PNM to increase solar capacity.

Keller half-jokingly mentioned that the city has a battery chemistry problem, an oblique reference to the much-maligned ART electric bus project he inherited, which recently rejected all buses due to their ineffective batteries.

“We’d like it if someone can make a bus battery that can have a 270-mile range. We know that the competition can only do 100 hours,” Keller said.

One of Albuquerque’s biggest draws, the Balloon Fiesta, brings with it logistical concerns. Traffic delays are up significantly during the fiesta, in part because the city has outgrown the Balloon Park and most nearby land is in private hands. Finding a solution will require more brain power, he said.

Keller closed by asking that people volunteer and point potential candidates to the city’s jobs. Volunteer coordinators from the city of Albuquerque were on hand to discuss volunteer opportunities in the Albuquerque Police Department and other city services.

The Community Engagement Speakers Series offers Sandia staff a way to discuss community issues and learn how to make a direct, positive impact.

New computing center opens for business — Astra supercomputing business, that is

by Neal Singer

On Nov. 28, Sandia’s new Astra supercomputer stood bathed in violet and blue-green lights inside a newly built white-walled building with a 30-foot-high ceiling — long and wide enough to house a basketball game and a crowd of spectators.

About 200 Sandia staff and visitors sat on chairs or

last year.

The building, LEED gold-certified, was designed and built in 18 months at an estimated cost roughly half that of renovating an older building. The Leadership in Energy and Environmental Design rating system is the most widely recognized rating system for highly efficient, environmentally responsible green buildings.

In addition, award-winning thermosyphon work led by “visionary engineer David Martinez” is expected to save several million gallons of water normally needed for supercomputer cooling, said senior manager Tom Klitsner.

The supercomputer, the first ever built of Arm microprocessors with the intent of broadening the supplier base for future computers, was assembled in a month, but still placed 36th in the global TOP500 High Performance Gradients Conjugate test that Sandia helped design. It achieved that performance despite the fact that a quarter of its processors had not yet been installed at the time of the test.

Most powerful Sandia machine ever

Its theoretical peak of 2.3 petaflops makes it the most powerful supercomputer ever installed at Sandia.

Host and director Scott Collis described the extraordinary lineage of computing at Sandia, beginning with the Paragon, the world’s first parallel processing computer to lead the bi-annual Top500 list in speed; recipient of the inaugural Gordon Bell Prize; the design and installation of ASCI Red, the world’s first teraflop computer; and Red Storm, a computer whose design became a mainstay of Cray Inc.



COLORFUL MACHINE — Senior manager Ken Alvin describes Sandia’s Vanguard program and the Astra machine. (Photo by Lonnie Anderson)

This history has continued more recently in close partnership with Los Alamos National Laboratory, with the Cielo and Trinity supercomputers, each tracing their lineage to Red Storm, Scott said.

Senior manager Ken Alvin described the intent of the project to “accelerate across the gap of experimental to production technology” under Sandia’s Vanguard program, which invests relatively small amounts of money in new technologies to see if they work out, rather than betting the farm by investing heavily on every new approach.

Astra is the first of this experimental line, and its success may mean more, and larger, supercomputers using the Arm technology in the future. Arm processors previously had been used exclusively for low-power mobile computers, including cell phones and tablets. A single Astra node is roughly one hundred times faster than a modern Arm-based cell phone, and Astra has 2,592 nodes.

Astra project lead James Laros, described by Ken as the man “who more than anyone is responsible for the machine being here today,” recounted the thrill of getting the computer up and running in so short a time.

“Challenges for technical people are why people come to work at national laboratories,” James said.

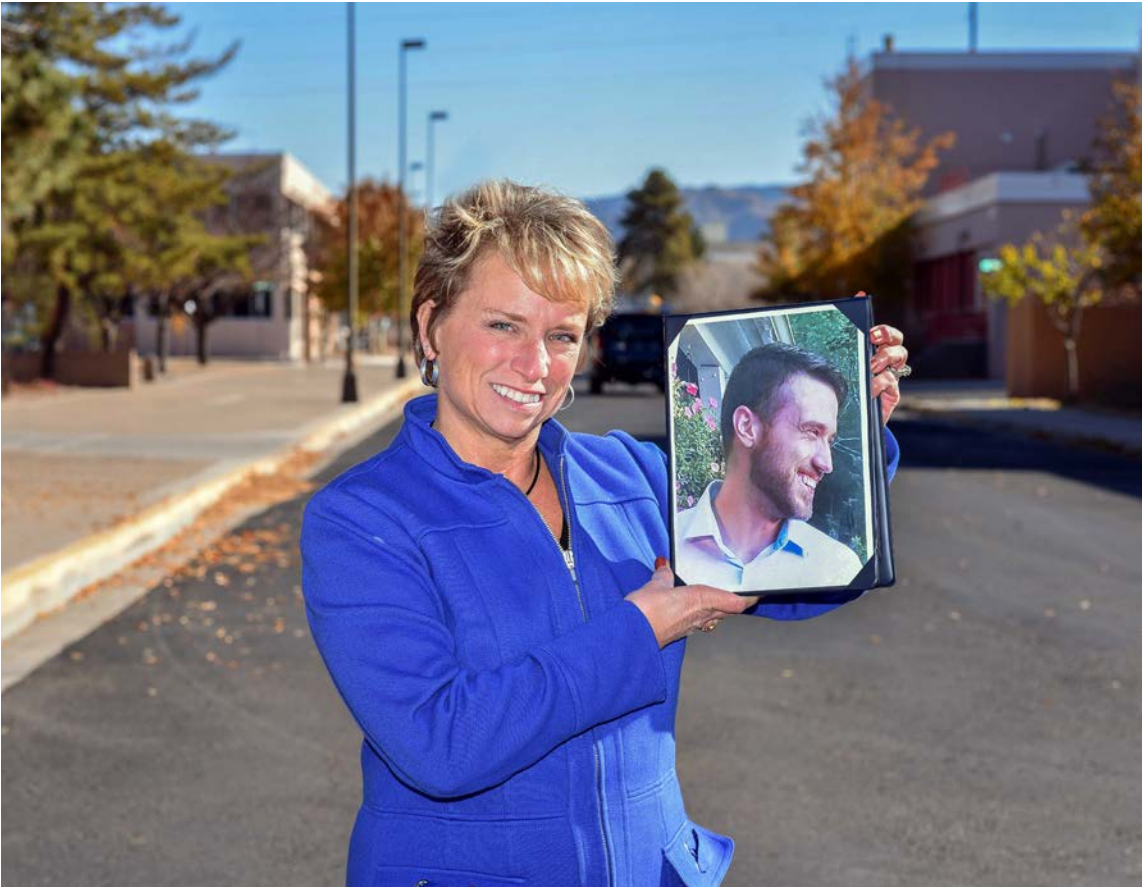


SAVING THIS MUCH WATER — David J. Martinez (right) describes to Warren Hunt and others the water conservation successes in the supercomputer cooling effort that David leads. (Photo by Rebecca Gustaf)

stood to watch the ceremonial cutting of a foot-wide golden ribbon to celebrate the formal opening of the facility and, unofficially, the first-of-its-kind supercomputer it houses.

“It may not be the fastest computer in the world, but it’s probably the most attractive,” joked deputy Labs director Dave Douglas as he examined the computer’s lighting and surface art. Dave also remembered “standing with a shovel on a cold and rainy day,” when he took part in the groundbreaking for the building

Support group aims to curb fears of discussing addiction



SAFE SPACE — Consequence assessor Theresa Rolfe holds a photo of her son Ted Benoit. Rolfe started the Family and Friends of Addicts Support Group at Sandia to give employees a place to share what they’re going through. Her son was addicted to heroin and now works full-time at a recovery center in Connecticut where he helps men with drug and alcohol addiction. (Photo by Randy Montoya)

By Manette Newbold Fisher

Almost every morning on her way to work, Theresa Rolfe drives past homeless people outside a fast food restaurant, and the sight takes her back to a time when her son could have been among them.

It wasn’t too long ago that Theresa, who works in emergency management, cried all night wondering why he had left a detoxification facility with nothing more than an extra pair of underwear. He’d been to drug rehabilitation and relapsed, and for a while, his location was a mystery.

From the day she found out he was addicted to heroin until she found online support groups where others dealt with similar issues, Theresa said she felt alone. Her son has been clean and sober for more than a year now, and she has others to talk to. However, because she doesn’t want others to experience the same dark roads, she formed a support group at Sandia.

The Family and Friends of Addicts Support Group meets twice a month during the lunch hour to discuss what members are going through. Theresa’s son went through rehabilitation twice, but she knows others at the Labs are struggling. Since starting the group, she’s had several employees call to talk and managers call on behalf of staff members.

Out of the darkness

“I felt there was a need for people not to be ashamed anymore because when you’re ashamed, if you hide it away, it can’t get better,” Theresa said. “I think for things to get better, you’ve got to take the issue out of the darkness and put it into the light.”

Theresa’s son now works full-time helping other men through drug and alcohol addiction at the facility that helped him get clean, in Connecticut. Theresa is very proud of where he is now.

Group stresses employees won’t lose security clearances

Although Sandia endorsement isn’t required, Theresa went through the Labs’ onsite counseling office before starting the group, and gained support from Sandia clinical psychologist Kristina Rynes.

“I thought the support group was such a great idea,” Kristina said. “Sadly, nobody is completely immune to this.”

Before the support group began, others had established alliances for grieving employees and caregivers at Sandia. Staff can also reach out to counselors for individual help with anxiety, depression, marital issues and workplace problems, and counselors can guide them to long-term therapy if needed.

Kristina doesn’t attend the support group meetings, but if someone in the group wants to talk to a professional or if they need a guest speaker, she can help. At Sandia, onsite counseling is free.

It’s common in the workplace for people to keep quiet about struggles with family and friends, and at Sandia, there’s the added worry about losing security clearances, which are required for most jobs at the Labs.

“No one wants to be viewed in a less-than-perfect light,” Theresa said. “People will always say the good things. Your son is exceeding, your daughter is valedictorian. My son’s a drug addict. I knew there was a risk putting my name out there, but I didn’t care. This is

way more important. If somebody wants to judge me, or look down on me, or more importantly my son, that’s not my problem.”

Sandia requires self-reporting of drug abuse and employees are also subject to random drug screenings, but they won’t lose clearances based on the behavior of family or friends.

“That has been a large concern that other people have,” engineer Ian Young said about employees losing clearances. He’s been attending the support group for several months and called the security office to doublecheck Sandia’s drug policy. “You should know that going to a support group won’t affect your clearance.”

‘A phone call can wreck your day’

His productivity went downhill when Ian discovered his dad used cocaine and methamphetamines, and the ups and downs continue. He always knows when his dad isn’t doing well when collection calls come in, or when he receives another driver’s license for his dad in the mail.

“He’s constantly losing his wallet and license and everything when he’s not doing well,” Ian said. “You can get to the state where a phone call can wreck your day.”

Ian and Theresa both said even when things are going well, it’s a state of fragile calm.

“Every time my phone rings, I look at it just to make sure it’s not my son and if it is, I answer right away because I think, ‘Are you OK?’” Theresa said. “That’s all stuff I’ve got to get over.”

A place where others ‘get it’

If group attendees don’t feel like talking during the meetings, Theresa comes prepared with topics related to drug addiction. She knows numbers and statistics, has advice about finding good rehabilitation facilities and learns about events that could be helpful for those in the group.

“You don’t have to say your name. You are welcome to turn your badge around and you don’t even have to share if you don’t want to,” she said. “I understand people are kind of hesitant to share, but I also know if they go to that meeting, they want to share whether they realize it or not.”

Ian said the support group gives attendees a place to connect with others who understand drug issues, unlike friends and co-workers.

Kristina said one of the benefits is not having to start from scratch. “People just get it,” she said. “When you’re in a supportive group, everyone is sort of nodding their heads and saying, ‘I know.’”

Theresa said she hopes as more people find out about the group, more will attend.

“Not acknowledging it won’t make it go away. In fact, that’s probably the worst thing we can do,” she said. “An addict is somebody’s son, daughter, brother, sister, parent or friend. There’s somebody underneath the addiction. They’re there. And I never want somebody to feel so alone and desperate as I have felt.”

The Family and Friends of Addicts Support Group meets the first and third Wednesday of the month from noon-12:45 p.m. in Building 823, Room 2093.

Questions to Theresa Rolfe at 844-1702.

Retiree deaths

Susan Gloria Smith (age 73)	January 11
Judy Davenport (66)	March 22
Clifford Schafer (84)	May 14
George Rafal (74)	May 22
Carl Curtis (86)	May 30
Ruth Dillon (91)	June 8
June Winter (84)	June 11
Frank Biggs (90)	June 18
Adelicio Herrera (93)	June 22
Rudy Lucero (91)	June 22
Frances Aaron (93)	June 24
R. Robinett (91)	June 26
Donald Veca (87)	June 27
Wendell Nelson (85)	June 28
Patrick Chavez (64)	June 30
La Wildgoose (91)	July 1
Lewis Fjelseth (90)	July 5
Robert Altherr (95)	July 7

Robert Altherr (95)	July 7
Emery Postenrieder (90)	July 21
Nina Coe (85)	July 25
Julia Ann Cooper (85)	July 27
Armand Stihlaire (96)	July 27
Marvin Moss (88)	July 29
Valla Cowan (93)	August 2
Leon Seibel (76)	August 20
F. Ramirez (98)	August 22
Elmer Smith (85)	August 23
Glenn Folkins (89)	August 24
Edwin Johnson (94)	August 24
Lee Kauffman (76)	September 2
Cynthia Caton (60)	September 7
James Hillman (88)	September 7
Richard Gido (84)	September 8
Fred Gutierrez (77)	September 11
David Smith (70)	September 12

Jose Castillo (81)	September 13
William Bedwell (96)	September 14
Josie Shapiro (82)	September 15
Donald Coates (78)	September 17
Paul Sanchez (60)	September 20
Simeon Teisher (94)	September 20
Thomas Gutierrez (67)	September 23
Ramon Lucero (99)	September 29
Robert Thompson (88)	September 29
Howard Nunez (93)	October 12
Abedon Ortiz (86)	October 12
Rachel Lujan (84)	October 16
Oliver Rohrbach (83)	October 16
Duane Burgeson (92)	October 23
William Sullivan (72)	October 23
James Foesch (73)	November 1
Ronald Andreas (79)	November 3

SANDIA CLASSIFIED ADS

Note: The Classified Ad deadline for the January 4, 2019, Lab News will be Thursday, Dec. 20, at noon.

MISCELLANEOUS

ENCYCLOPEDIA BRITANNICA, 1989, 15th edition, 30-vol. set, \$325 OBO; tile saw, RIDGID, 7-in. angle cut feature, on stand w/wheels, \$425. Sanchez, 505-515-5997.

LUMINARIA LIGHT SET(S), indoor/outdoor, new, never used, \$35. Willmas, 505-907-9324, djwillmas@gmail.com.

WEIGHT BENCH, adjustable BodyChamp 2600, 185-lb. weights, 4 dumbbells, \$240; Cherokee wheels, 4, original 16"x7", \$175. Martin, 505-821-6766.

VINTAGE MINK, cape, stole, shrug & coat, \$250-\$800 OBO. Brooks, 505-550-9536.

WEIGHT BENCH, foldable for easy storage, leg extension /curl, preacher curl attachments, inclines, mid-width, \$125. Valdez, 505-550-1993.

CHRISTMAS CDS, Celine, David Lanz, Three Tenors, Boston Pops, Hampton String Quartet, Mannheim Steamroller, Vienna Gala, pristine condition, \$2.50 ea. Wagner, 505-504-8783.

DIAMOND RING, Marquise, .77-ct., SI1-SI2 color: J; princess, .66 tcw; 14K yellow/18K platinum, appraisal \$8,200, asking \$7,000. Myers, 505-459-0799.

TABLE, glass-top, 42-in., 4 upholstered chairs, neutral colors & design, perfect for any décor, excellent condition, \$700. Wells, 505-292-0179.

MEN'S CYCLING SANDALS, Shimano, size 8-1/2 medium, unused, ordered by mistake, paid >\$100, asking \$50. Drebing, 505-293-3335.

LED TVS, 2 available, Hitachi, 55-in., 1080i, 3 HDMI, w/Roku stick, USB, optical/digital audio, \$200 ea. Valdez, 505-440-4630.

MARIACHI CHRISTMAS TICKETS, 4, Popejoy Hall, Dec. 9, 3 p.m., back row of orchestra on the end, \$35 ea. Aragon, 505-225-6288.

REESE KWIK-SLIDE 5TH WHEEL HITCH, 15K, w/BedSaver safety catch, \$275. Perrine, 505-363-3072.

KING MATTRESS, Tempurpedic supreme cloud, excellent condition, \$750. Fleming, 505-869-9165.

PHOTO EQUIPMENT, Canon, Nikon, Toyo, bodies & lenses; ham/shortwave equipment, Drake, ICOM; floor jack, 3-ton, \$80; call for info. Wolfgang, 505-414-1483.

KITCHEN DINETTE SET, 45-in. diameter, glass-top table, 4 chairs, 2 matching bar stools, \$250 OBO. Pfeifle, 505-856-6775.

DRONE, Mavic Pro original, 4 batteries, ND filters, battery charger, controller, carry bag, extra props, \$850. Soo Hoo, 505-821-9491.

ELECTRONIC ANIMAL TOYS, from 1990s, 3 dogs, 2 cats, parrot, bird, mouse, 2 plants, robot, \$40 OBO. Ashby, 505-908-6026.

KING HEADBOARD, footboard, sideboards, mid-dark wood; off-white queen bdr. set; light wood office furniture w/chairs. McKeever, pmckeever1@comast.net.

WOMEN'S SILVERADO JACKETS, 4, sizes large/X-large, excellent condition, photos available, \$50 ea. OBO. Knief, 505-821-3868.

DUST COLLECTOR SYSTEM, Grizzly, industrial air filter, numerous hoses, connectors, \$3,000 value, very lightly used, make offer. Amend, 505-453-4751.

FILING CABINET, IKEA, 4-drawer, birch color, tipping prevention, \$100 ea. or \$150/both; treadmill, LifeFitness T3 Flexdeck, 20 yrs. old, gently used, good working condition, \$150. Curtis, 505-280-0534.

CHRISTMAS TREE, 7-ft., fiber optic, pre-lit, Celestial by Puleo, \$50. Hall, 505-359-9334.

TRANSPORTATION

'99 FORD BRONCO, AT, AC, heater, white, newly rebuilt tranny, low miles, 166K miles, \$8000. Barraza, 505-595-4030.

'14 TACOMA, double cab, 4WD, silver, tow pkg., electronic braking, camper top, roof rack, bed liner, \$28,000. Dinger, 505-818-8933.

'71 MERCURY COUGAR XR7, very good condition, needs minor body work, \$12,000 OBO. Davison, 505-323-9961.

How to submit a classified ad

DEADLINE: Friday noon before the week of publication unless changed by holiday. Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 505-844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: Click on the News tab at the top of the Tech-web homepage. At the bottom of the NewsCenter page, click the "Submit a Classified Ad" button and complete the form. Questions to Michelle Fleming at 505-844-4902.

Due to space constraints, ads will be printed on a first-come, first-served basis.

'07 NISSAN ALTIMA, 2.5L, fully loaded, leather, 166K miles, clean condition, 505-550-9716.

'03 HONDA PILOT, 4WD, tow pkg., seats 8, runs fine, needs work on control arms before alignment, \$3,000. Haltli, 505-306-6031, ask for Jenny.

RECREATION

'12 YAMAHA FZ6R, 600 cc, sport bike, 4K miles. Long, 505-554-5747.

'99 KAWASAKI VULCAN NOMAD, w/Champion Legend sidcar, photos at <http://winaims.brinkster.net/images/mc.jpg>, \$6,000 OBO. Humbert-Hale, bob@winaims.com or 505-480-6824.

REAL ESTATE

3-BDR. HOME, 2-1/2 baths, 2,148-sq. ft., many updates, wooded 0.99-acre, East Mountains, 30 mins. to KAFB, \$329,000. Wise, 505-350-5014.

2-BDR. CONDO, 1,131-sq. ft., in foothills, 20 mins. to KAFB, \$130,000. Barr, 505-515-6219, after 5 p.m., ask for Anna.

4-BDR. HOME, 1,700-sq. ft, cul de sac, large covered backyard patio, north Four Hills, quiet area, \$225,000. Burnett, 505-974-5668.

WANTED

ROOMMATES, share 3-bdr. home, 2 baths, Juan Tabo/Spain. Clinger, bclinger7@gmail.com.

'99-'03 FORD TRUCK, 4x4, crew cab, long bed, 7.3 engine, manual transmission. Walter, 505-688-1806, ask for Jordan.

SNOWMOBILE, for tree hunting, 9th annual trip, 12/15, any condition, rent or buy, hook for dragging tree desired. Groysman, 224-430-1858.

POWERPOINT EXPERT, need help designing template, transforming existing slides into new look & feel. Hunt, 505-385-7089, ask for Gil.

Tritium experts gather at Sandia for 40th meeting



TALKIN' TRITIUM — Lynelle Takahashi and Russ Jarek of component science address attendees from across the NNSA enterprise, the United Kingdom, Canada and academia at the 40th Tritium Focus Group meeting held at Sandia. (Photo by Rebecca Gustaf)

The Labs' component production team last month gathered tritium users and other partners for a major meeting on the use and properties and other topics related to the H-3 isotope. More than 80 attendees heard a wide range of talks from a variety of experts and key representatives of the national tritium program at the 40th Tritium Focus Group Meeting.

Invited talks covered tritium facility capabilities, tritium separation methods, tritium waste, tritium characterization and tritium interactions with bulk materials and thin films. Sandia's Russ Jarek presented an overview of the tritium operations and capabilities within neutron generators. Jon Zimmerman presented an overview of the materials and hydrogen isotope research activities at Sandia California.

Participants traveled to Albuquerque from Los Alamos, Lawrence Livermore, Pacific Northwest, Idaho, Fermi and Savannah River national laboratories, the Savannah River Site, the Atomic Weapons Establishment in the U.K., the Canadian Nuclear Laboratories and Omega Lab for Laser Energetics at the University of Rochester. Program leads from DOE/NNSA in attendance included director Nanette Founds and Curtis Chambellan, both from the NNSA Office of Tritium and Materials Management; and Bill Weaver, program manager in the DOE Office of Chief Nuclear Safety.

At Sandia, neutron generator and gas transfer systems staff are focused on tritium handling and material degradation issues. Tritium loading and characterization of neutron tube targets are among key component work conducted at the Labs.

Managers get immersion in essential nuclear weapon topics



FLYING DETERRENT — Students from last year's Essential Topics for Nuclear Weapons Management course stand beneath a B-2 Spirit bomber at Whiteman Air Force Base in Missouri. (Photo courtesy of Larry Schoof)

Sandia managers who need to know more about the Labs' nuclear deterrence program are invited to apply to the fourth offering of the Essential Topics for Nuclear Weapons Management course.

Sponsored by stockpile management, the course is for managers who would benefit from an accelerated introduction to the program, said Larry Schoof of stockpile management. More than 100 managers have gone through the course, which focuses on Sandia's engineering role within the NNSA enterprise.

Course elements include about 100 hours of classroom instruction and optional field trips to key sites. Classes will meet most Fridays from early March through July 2019. Those who complete the course sat-

isfy the requirements of the Labs' knowledge development program weapon manager role.

"This is the most valuable set of classes and experiences I have ever had," said Anthony Chavez of power sources. And Mark Soo Hoo of asset security said, "The course content presented by subject matter experts who have a rich legacy of specific NW projects has provided a historical perspective that has proven to be essential to the success of my current work assignments."

Students in the third edition of the course are taking field trips to Sandia's sister weapon labs, sites and plants and NNSA headquarters, in addition to U.S. Strategic Command, the Pentagon and other DoD sites.

"The field trips to various Nuclear Security Enter-



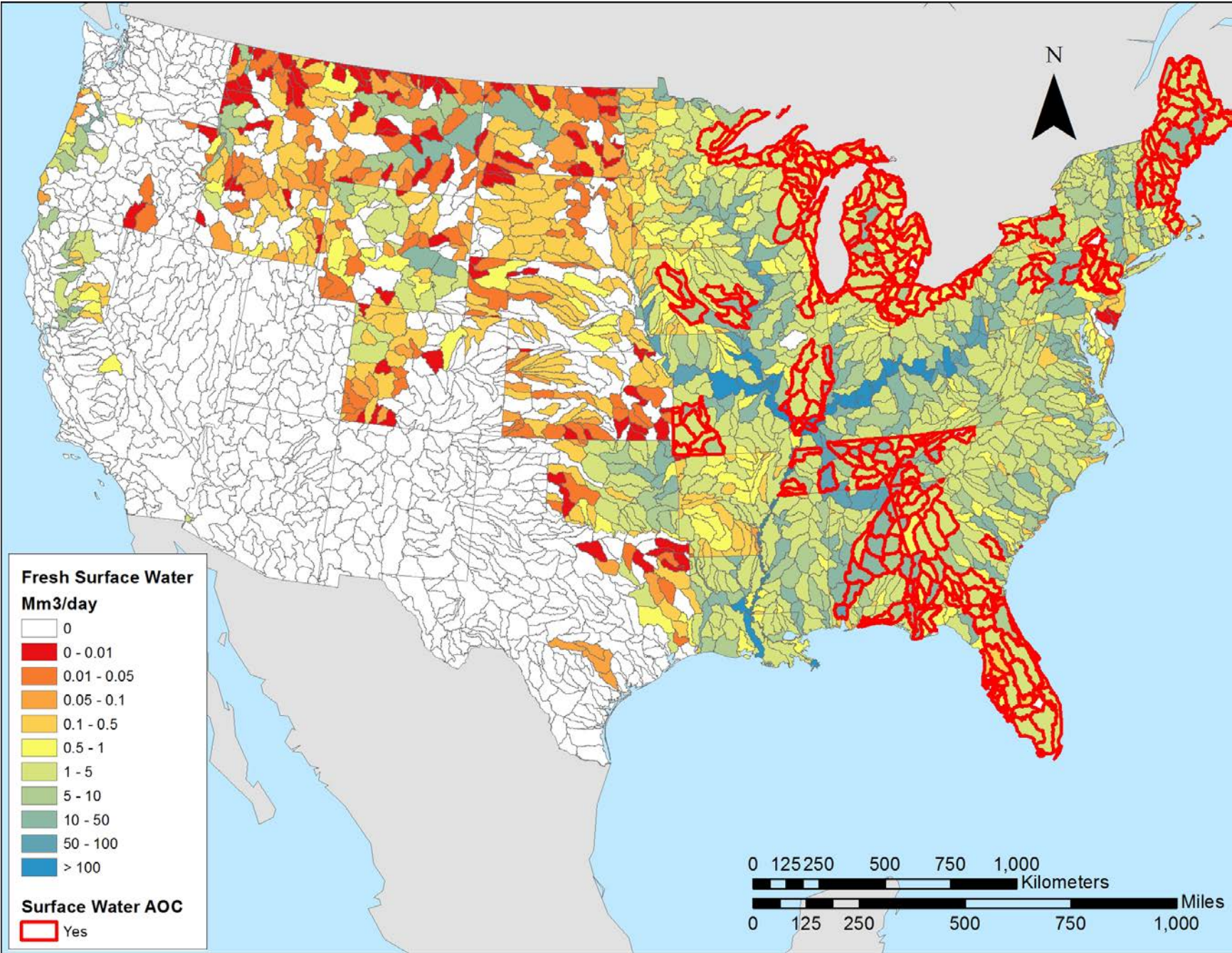
MEET THE BOSS — The 2017 ETNWM class encountered DOE Secretary Rick Perry during their visit to the Pantex Plant. (Photo courtesy of Larry Schoof)

prise sites provided even more context and appreciation for all aspects of nuclear weapon design, test, production and deployment," said Chris Eiting of systems engineering.

Larry said he developed the curriculum for the course after receiving numerous requests for a manager-friendly version of the Weapon Intern Program, for which Larry is project lead. He based course studies on a series of high-level discussions of the modules in the intern program: nuclear policy, nuclear weapon systems and their evolution, customers and requirements, nuclear and non-nuclear components, and weapon design and assessment.

— Jim Danneskiold

Sandia helps provide water data for secure energy supply



MAPPING HOW MUCH WATER — Water availability data helps operators of thermo-electric power plants ensure a stable supply of energy, despite uncertainties. “We’re looking at the whole energy infrastructure and considering the risk water availability imposes on the system and how we can grow the system in a way that is more robust

to uncertainties in the water system,” Sandia’s Vince Tidwell said. (Graphic from the article, Mapping water availability, cost and projected consumptive use in the eastern United States with comparisons to the west by Tidwell and co-authors, Environmental Research Letters 13, 014023, January 2018.)

By Mattie Hensley

In recognition of Thanksgiving, the Energy Information Administration (EIA) highlighted how U.S. families use energy in the kitchen. Not surprisingly, the EIA found that electricity powered nearly two-thirds of all cooking.

But when those 75 million households microwave holiday leftovers, do they think about how much water it takes to produce that energy?

Vince Tidwell does. His work focuses on the unique relationship between energy production and water use, referred to as the energy-water nexus, and he’s helped to map water availability, cost and use data for power plants.

Stable, resilient energy goal

Vince’s work in Sandia’s renewable energy group is part of a collaboration with Carnegie Mellon University, led by DOE’s National Energy Technology Laboratory, to develop data and models that show the link between thermoelectric power generation and water. Recognized earlier this year as an innovative water project, the effort’s goal is stable, more resilient energy for the nation.

Thermoelectric power plants require water for cooling but can be sensitive to changes in water supply and to competing uses.

Vince explained some of the major risks:

When water temperatures get too high in rivers or lakes used by the plants, he said, they shut down, a typical occurrence in a drought. Shutdowns can stress the grid since other plants or energy sources must pick up the load, Vince said.

Another risk is a drop in water rate or quality below the power plant’s minimum requirements.

A third risk is limited availability of fresh water, Vince said. Plant operators may incur significant permitting costs, only to find that a community doesn’t want its fresh water supplies used for a plant.

Data to evaluate water supply risks

The water data collected through the collaboration provides the kind of information that energy manag-

ers need to evaluate these risks to water supply.

“Over the past few years, we’ve collected data for the contiguous United States, and now we are collecting that data for Alaska and Hawaii,” Vince said.

Vince and his collaborators are also looking at current power plants and their contingency plans.

They ask, at what point are power plants subject to issues with water? How or what plan do they have to mitigate those impacts?

Project team members work with the three national interconnections of local electricity grids — which operate mostly independently of each other with limited transfers of power among them — to integrate water into their planning. They are helping those who manage the interconnect understand where

water could be a limiting factor in siting a plant and where water could adversely affect a plant’s ability to generate power reliably.

Sandia and its collaborators also are analyzing ways to predict plant output, including water resource requirements under various weather conditions, time scales and regional or plant-specific scenarios.

All of this work is conducted through the lens of energy security — hence Sandia’s involvement. The project is funded by the DOE Office of Fossil Energy, which is responsible for federal research, development and demonstration efforts aimed at advanced power generation.

“You can’t have a secure energy system without planning and consideration for water supply,” Vince said.



STEAM POWER — Steam generated from a bank of cooling towers at the San Juan Power Plant in northwestern New Mexico portrays one connection between water supply and energy. Like household air conditioners, cooling towers transfer heat from the power plant to the environment. Removing the heat allows the steam from the plant’s turbines to condense from a gas into a liquid. Researchers are seeking ways to capture it and reduce the amount of water used by fossil fuel-fired power plants. (Photo by Vince Tidwell)